

Issued October 22, 1912.

U. S. DEPARTMENT OF AGRICULTURE,
FOREST SERVICE—BULLETIN 114.

HENRY S. GRAVES, Forester.

IN COOPERATION WITH THE STATE OF LOUISIANA LAND OFFICE,
F. J. GRACE, REGISTER AND COMMISSIONER OF FORESTRY.

FOREST CONDITIONS IN LOUISIANA.

BY

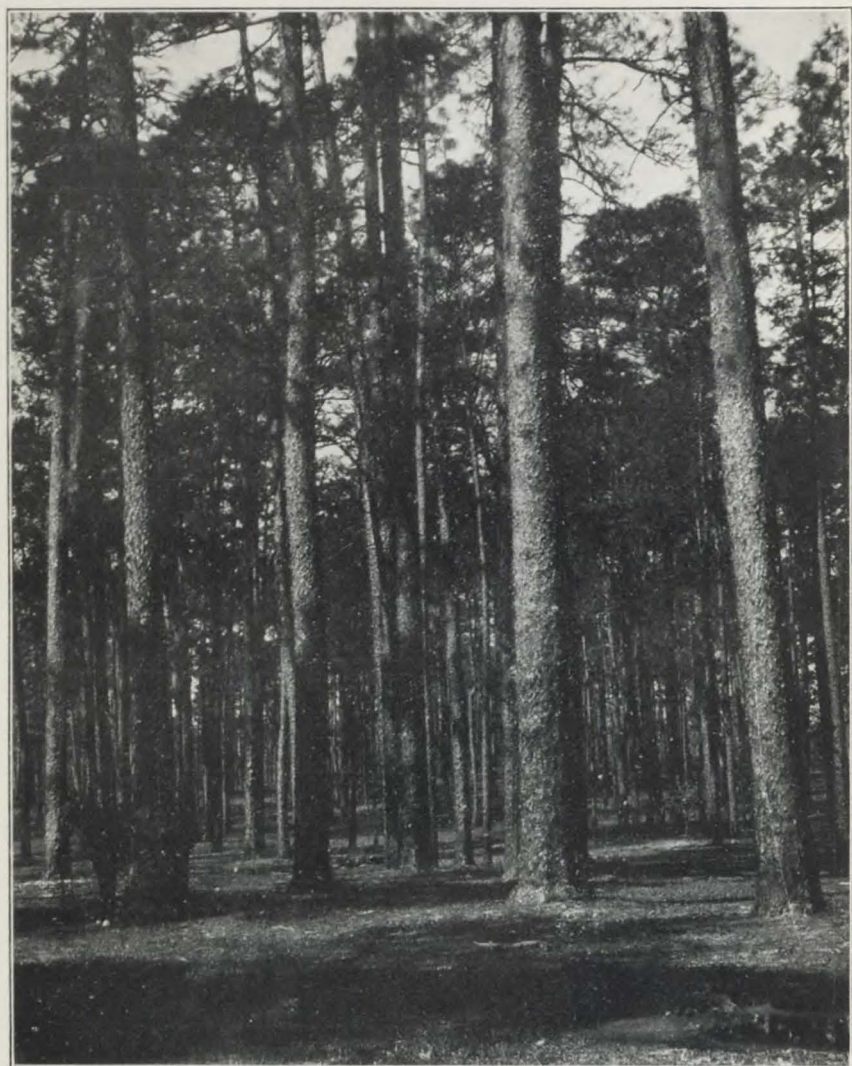
J. H. FOSTER,

ASSISTANT CHIEF, STATE COOPERATION



WASHINGTON:
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1912.



VIRGIN LONGLEAF PINE FOREST IN VERNON PARISH.

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U. S. DEPARTMENT OF AGRICULTURE,
FOREST SERVICE,
Washington, D. C., May 28, 1912.

SIR: I have the honor to transmit herewith a manuscript entitled "Forest Conditions in Louisiana," by J. H. Foster, Assistant Chief, State Cooperation, Forest Service, in cooperation with the State of Louisiana land office, F. J. Grace, register and commissioner of forestry, and to recommend its publication as Bulletin 114 of the Forest Service.

Respectfully,

HENRY S. GRAVES,
Forester.

HON. JAMES WILSON,
Secretary of Agriculture.

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FOREST CONDITIONS IN LOUISIANA.

PURPOSE OF THE BULLETIN.

Among the States, Louisiana is peculiarly rich in forest resources. In the production of lumber she ranks second, and in quantity of standing timber is surpassed only by the Pacific Coast States and Idaho. Yet, should the present rate of cutting be maintained, the virgin stands of cypress, pine, and hardwoods must entirely disappear within 30 years. Without doubt, much of the land cleared of timber would be put to agriculture, but the forest is being removed much faster than agricultural development is taking place, and even in the end there will still remain many thousands of acres better suited to the growing of timber than to the production of crops. Cut-over lands, especially the pineries, offer an exceptional opportunity of solving the question of a future timber supply. The immense potential value to the State of young forest growth is coming to be realized. With efficient protection of this young growth, and better utilization of the present commercial stands, the forests of Louisiana, even in the face of a much greater agricultural development than now, should remain an important source of wealth.

The purpose of this bulletin is to describe the present forest conditions in Louisiana, discuss the problems which must be met in connection with them, and tell of the progress already made in the establishment of a sound forest policy for the State.

PHYSIOGRAPHIC FEATURES OF THE STATE.

More than 23,000 square miles, or about one-half of Louisiana, is alluvial land formed by the Mississippi and Red Rivers, the chief drainage channels of the State, which have carried down from their upper courses and deposited over this vast region a soil exceedingly fertile. In the southwestern part of the State is a great prairie region, the result of the almost complete erosion of the bluffs which once bordered the alluvial lands on the west side of the Mississippi. Bluff deposits still exist, particularly on the east side, though they have eroded nearly to the general level of the surrounding country. In the central portion of the State is the pine region, a rolling and generally well-drained area, where the rock formations are covered

with recent deposits of clay and sand. Bordering the entire coast is a vast sea marsh in process of reclamation by deposits, both from the high tides which cover them and from the streams which seep through them from the north. Only over small areas do elevations exceed 300 feet; over more than four-fifths of the State no elevation exceeds 100 feet. Geologically, Louisiana is very young. Even in the northwest, the oldest region, the geological history dates back only to the beginning of the Cretaceous period, while the bluff and prairie lands, alluvial bottoms, and sea marshes are, for the most part, still in process of formation.

The proximity of Louisiana to the Gulf of Mexico gives the State a uniform climate and cool, moisture-laden winds. The summers are long, though the temperature rarely exceeds 95°. The winters are short and mild, the temperature averaging about 53° in the southern parishes and 45° in the northern. The average annual precipitation ranges from 70 inches at New Orleans to about 45 inches in the extreme northern part of the State. Most of the rain comes during the summer and winter; the spring and autumn are comparatively dry. Snow seldom falls even in the extreme north.

TRANSPORTATION.

Louisiana has 3,800 miles of navigable water, and every part of the State is open to transportation by this means. Many streams find their way into the Mississippi and Red Rivers from northern Louisiana and Arkansas, and nearly all of them are navigable through the State. South of the junction of the Red and Mississippi Rivers a network of streams and bayous extends to the Gulf. Many of the bayous are navigable, and during periods of high water, at least, bring every portion of the alluvial lands into touch with outside markets. A system of levees more than 1,700 miles in extent keeps the main rivers and bayous in their banks. The deepening of channels and the extension of the levee system will give a great impetus to the clearing of alluvial lands for agriculture.

Water, the original channel of entry into the State, has within recent years been in a measure superseded by the railroad. Every parish in Louisiana, except Cameron, which is almost entirely within the sea-marsh section, has one or more railroads passing through some portion of it. Most of the trunk roads operate branch lines, and, as in other States, logging roads have often become permanent carriers. It is likely, however, that the comparative unimportance of the waterways as means of transportation will be only temporary, and that in future water traffic will have an important place in the industrial development of the State. Already many steamboat lines are being organized for interior traffic.

Public highways near the principal cities are usually good, but the majority of those in the country are poor. The development of good roads, however, promises to make rapid advances in the future. There is particular need at present for betterment of the roads in the hills and uplands where heavy hauling is necessary. In the alluvial region the waterways to a large extent take the place of highways.

LABOR.

In southern Louisiana common labor in the woods is performed almost exclusively by negroes, who are best able to withstand swamp conditions. Negroes also perform most of the labor in the sawmills and woods of the pine regions of central Louisiana, where they receive from 50 cents to \$1.50 per day. They may, in fact, occupy responsible positions, such as sawyers in the mills. In northern Louisiana much of the common labor is performed by white men. Some of the mills employ white labor exclusively.

OWNERSHIP OF LAND.

Prior to the purchase of Louisiana from France, both the French Government, and before it the Spanish Government, made extensive grants of land. These were located almost exclusively along the rivers and bayous, from which they extended back into the swamps. In many instances the land is still in the families of the original grantees. All lands in the State not included within these grants are covered by the Public Land Survey of the United States. The portion of Louisiana east of the Mississippi and north of Lake Pontchartrain is not a part of the Louisiana purchase, but of Florida, and its divisions are still called the Florida parishes.

Under the swamp-land act the United States granted to Louisiana, in 1841, 500,000 acres, and, in 1849, 10,000,000 acres of alluvial lands for drainage and disposition. Most of these lands have been sold through the State land office and the levee boards of the various drainage districts of the State. About 2,000 acres still remain under the jurisdiction of the State land office, and a small number of acres are in the hands of each levee board. The proceeds from the sale of these lands are put into the State treasury as a fund for levees and drainage.

By the act of 1908 State lands are now disposed of by sale to the highest bidder at the following fixed minimum prices per acre: Untimbered, \$2.50; cypress, \$10; pine, \$8; hardwoods, \$8; dry lake, \$3; prairie, \$10; and sea marsh, \$0.25. The most valuable lands, however, are already in private hands, and those remaining are invariably denuded of cypress and so situated that cultivation is impossible except by extensive drainage.

Most of the school lands granted to the State by the Federal Government have been sold, usually for less than 10 per cent of their present value. Probably not more than 60,000 acres of public land are left in the State for disposal by the Federal Government.

Before 1891 public lands could be disposed of indiscriminately at public sale at \$1.25 an acre. Thousands of acres of timberland were purchased by far-sighted investors, among them many northern lumbermen, who saw the end of the great pine forests of the Lake States. Following the general exhaustion of northern pine, timber companies were organized in the South, and the yellow-pine industry soon became important. During the last few years syndicates have purchased great tracts of timberland. Some of these speculative holdings aggregate hundreds of thousands of acres. Consolidation of timber holdings of all classes is proceeding rapidly. The remaining cypress is already in the hands of a comparatively few men. Since the uplands of northern Louisiana have been exploited for many years the ownership of land in that region is widely dispersed.

AGRICULTURE.

Agriculture is highly developed along the Mississippi and Red Rivers and the bayous of southern Louisiana and in the prairie and bluff regions. On thousands of acres sugar, rice, corn, and other crops are cultivated in almost continuous farms. In the upland district, where the farms are usually small, agriculture has not been so highly developed as it will be. Large areas in the alluvial bottoms of the northern part of the State that were under cultivation before the Civil War are now reverting to timber. Of the total land area of about 28,000,000 acres, probably not more than 5,500,000 acres are in cultivation.

THE FORESTS BY REGIONS.

Louisiana may be divided into six regions—shortleaf-pine uplands, longleaf pine region, alluvial region, bluff region, prairie region, and sea marsh. Each of these regions is distinct to a degree not often found even in States where the topography is much more abrupt and climatic variations more marked. In Louisiana the variation of only a few feet in the elevation often influences the natural conditions over immense areas.

SHORTLEAF-PINE UPLANDS.

Shortleaf-pine uplands include the northwestern portion of Louisiana, intersected, however, by the alluvial valley of the Red River, which crosses the State diagonally. Southward the uplands pass almost imperceptibly into the longleaf-pine hills. A relatively small

area of shortleaf-pine uplands also lies east of the Mississippi River, occupying nearly the whole of East Feliciana Parish and portions of adjoining parishes. The elevations of the upland region are the highest in the State. The topography is abrupt and hilly, with good drainage. The soil is sandy loam and fertile, but subject to severe erosion when denuded of timber.

On the dry ridges the forest consists of pure stands of shortleaf pine; on the lower slopes and creek bottoms, of various oaks, red gum, ash, hickory, beech, maple, yellow poplar, sassafras, holly, magnolia, and other species; and on intermediate lands of a mixture

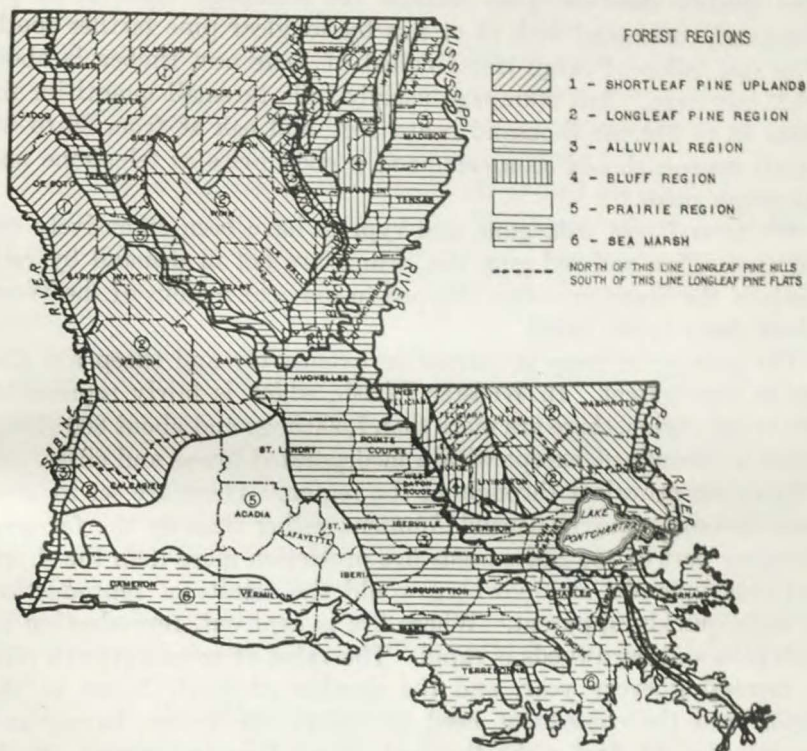


FIG. 1.—Forest regions of Louisiana.

of these species with shortleaf and loblolly pine. The undergrowth is usually dense. Small cypress brakes are common on overflowed lands, but the original cypress has almost entirely disappeared.

The character of the forest in the upland region east of the Mississippi River was originally the same as that in the upland region west of it, but the virgin pine and the best oak and other hardwoods have practically disappeared. Though there are many promising stands of second-growth pine, fully three-fourths of the region has long been settled, and is in cultivation or pasture. The greater part of the forests of the uplands west of the Mississippi has been

culled. In some of the more isolated localities, however, excellent oak, hickory, ash, and red gum timber may still be found. Tupelo and cypress of pole size are plentiful in the swamps. Along the Vicksburg, Shreveport & Pacific Railroad, one of the oldest lines in the State, lumbering has been carried on extensively for years. Many small operators are now cutting second growth, since much of the original pine has been sent into Arkansas for manufacture. The large sawmill companies of the region are cutting from the longleaf pine farther south. Even the largest timber tracts, containing from 8,000 to 16,000 acres, have been culled for the best timber. Where first quality shortleaf pine remains the stumpage value is \$5 per thousand, contrasted with \$4 or less for longleaf pine farther south. The sale value of large tracts culled of their best timber is about \$6.25 per acre. Ash stumpage usually sells in small quantities for from \$9 to \$12 per thousand board feet, and oak at from \$6 to \$8. Small cypress should soon command a good price as telephone and telegraph poles.

White and post oak, gum, and cypress have been extensively cut for ties. Pine and red gum ties, which are not in demand by railroads in the State, are often shipped to the arid regions of the West, where decay is less rapid.

The grazing of hogs is carried on extensively and sheep are also run to some extent. In Webster Parish, which is fairly representative of the region, there are more than 7,500 hogs and about 800 sheep. Stock is unconfined, except within incorporated towns and cities.

Fires are prevalent throughout the region. These are set in most cases by boys and irresponsible hunters, rather than by the farmers. No other part of the State needs fire protection more than the shortleaf-pine uplands, and nowhere would the results of reproduction be more quickly apparent. Where fire is kept out, reproduction of both pine and hardwoods is rapid. The value of second-growth pine is increasing every year, and the number of small farms in the region and the consequent need of timber for fences, barns, and houses, and for fuel make the protection of second-growth stands exceedingly important. Moreover, the forest cover on the watersheds of local streams would have much to do with regulating the flow of the streams farther south. Many farms in the longleaf hills immediately south of the region have been abandoned during the last few years, because of the destruction of crops during high water. In situations where the ground is badly eroded, the planting of rapid-growing trees, such as locust and catalpa, for posts would be profitable not only for the material grown, but also in checking erosion.

LONGLEAF-PINE REGION.

The longleaf-pine region comprises two widely separated areas. The larger of these extends through the central and western portions of the State, from the shortleaf uplands on the north to the prairies on the south, and from the alluvial bottoms of the Mississippi River on the east to those of the Sabine River on the boundary line with Texas. Like the uplands, the longleaf-pine area is divided by the Red River Valley.

The second area, which lies east of the Mississippi River and includes more than half of the Florida parishes, reaches from the Mississippi State line to the marshes of Lake Pontchartrain, and from the alluvial bottoms of the Pearl River to the upland and bluff regions on the west. Together the two areas occupy nearly one-fourth of Louisiana and contain the largest compact bodies of longleaf pine timber remaining in the United States.

The soils of the region are chiefly sands and clays, with an impervious subsoil of clay. East of the Mississippi River large areas of cut-over land have been transformed into productive truck farms. This section, because of its dry, healthful climate, pure air, and abundance of artesian water, is called the "ozone belt." As a whole, the longleaf pine region exhibits two distinct types—one, the rolling, well-drained hills of the northern portion, the elevation of which generally exceeds 100 feet; the other, the poorly drained flats along its southern boundary, the area of which is relatively small.

Practically all of the timber on the flats is pure longleaf pine. Occasionally, however, where the water level is close to the surface, loblolly pine appears in the stand. Because of their level nature and proximity to market these flats were cut over before extensive lumber operations began in other parts of the longleaf region. Such cut-over lands in the lower parishes furnish the bulk of the State's output of turpentine.

North of the flats the rolling pine forests spread in irregular bodies through the remainder of the region, with narrow belts of fine hardwood and loblolly pine timber in the creek bottoms. Sawmills located at close intervals along the railroads furnish employment to a large part of the population. The best oak, ash, and hickory have been cut, but red gum is still plentiful. The best longleaf pine timber in the State is situated in the rolling country about Vernon Parish and in parts of Winn Parish, north of the Red River. East of the Mississippi, in the rolling hills of Washington Parish and in the parishes south and west of it, there are also extensive bodies of excellent timber. Even in the heaviest forests, however, the timber has been cut over large areas. In Washington and St.

from \$2 to \$5 per thousand feet. This, however, will doubtless increase rapidly. Virgin shortleaf and longleaf pine, mixed with hardwoods in depressions and along the borders of creeks, form extensive forests that have been little exploited.

Everywhere on cut-over longleaf-pine areas there is an absence of reproduction, due to repeated fires. On the hills, where shortleaf and loblolly pine are mixed with the longleaf, reproduction is abundant and vigorous wherever fires are kept out. On the pine flats reproduction, even under the best conditions, is difficult, and where fires occur is practically impossible.

Throughout the region, especially in Calcasieu and Vernon Parishes, large numbers of cattle, sheep, and hogs graze in the woods. In the northern part of Calcasieu Parish there is estimated to be 100,000 head of sheep grazing on the lands of the large lumber companies. Upon the owners of stock rests the responsibility for most of the fires which burn over the ground each year. The practice of burning over land to increase pasturage is far less common in the northern parishes.

Within the last four years unprecedented wind storms have been exceedingly destructive to longleaf pine timber. It is estimated that at least 10 per cent of the standing timber in and about Washington and Tangipahoa Parishes has been uprooted since 1906. On certain areas as much as 65 per cent of the virgin timber has been blown down. Each of two companies estimated the amount of its wind-thrown timber at 200,000,000 feet, more than half of which would be a total loss. The first storm occurred in 1906, followed by another in 1908, and by a third, the most disastrous, in 1909. The damage resulted not so much from the violence of the wind as from its duration. Constant pressure against the trees loosened the lateral roots, and in the absence of strong taproots, due to the hard clay subsoil, the trees were overthrown. In the storm of 1909 most of the trees fell during the last part of the blow. Where wind-thrown timber is being logged the increase in cost of getting it out is estimated to range from 30 to 50 per cent. Wind-thrown timber during the summer months is immediately attacked by the Southern pine sawyer, which will seriously damage 25 per cent of the lumber in a log if it remains on the ground for any length of time.¹

ALLUVIAL REGION.

The alluvial region comprises nearly half of the State. On the west side of the Mississippi River it extends without interruption from the Arkansas line to the marshes along the Gulf of Mexico in

¹ For description and method of control see Bulletin 58, Part IV, Bureau of Entomology

a belt with an average width of from 30 to 40 miles. In addition it includes a strip about 10 miles wide bordering the Red River along its entire course through the State, the lowlands along the Ouachita, Sabine, Pearl, and other rivers and inland lakes, and portions of the parishes south of Lake Pontchartrain and east of the Mississippi River below Baton Rouge. The various parts of the region differ only in minor details. Elevations range from nearly sea level in the southern parishes to about 90 feet at the northern boundary. This difference in the elevation represents the fall of the Mississippi River; nowhere within the region is the land more than a few feet above the normal river level. During the flood season, from March or April to June or July, the greater part of this vast region is overflowed. At other times of the year only the swamps and cypress brakes are under water. Heavy rains at any season, however, result in slight overflow for a few days.

The sluggish streams which flow through the bottoms have in a measure built up natural levees. These are known as front lands, and are, with the exception of the cane ridges, which separate the waters of one stream or bayou from those of another, the driest situations in the region. They rise but slightly above the water level and slope back gradually to the deep swamps. In the northern parishes the differences in elevation are more marked, and the land can often be drained by ditching.

With the progress being made in levee building and drainage, it is certain that a large portion of the alluvial lands will ultimately be protected from overflow. Probably 5,000,000 acres in the southern parishes, now subject to inundation, can be protected and brought under cultivation. In the northern parishes drainage is, as a rule, less difficult.

The character of the forests in the alluvial region is determined by the drainage of the land. The principal types are:

(1) Deep swamps, overflowed throughout the year, containing stands of cypress and tupelo, and occasional water ash and red maple.

(2) The level or slightly undulating bottoms, subject to overflow only during the flood season, with a forest of white and swamp oaks, red gum, ash, elm, hackberry, hickories, black gum, cypress, and other less important species. Undergrowth, other than scrub palmetto, is lacking.

(3) The cane ridges, usually rising above high-water level, covered with a stand of oaks, hickory, red gum, and other species, with a dense undergrowth of cane and briars. The ridges are usually narrow and follow sinuous courses between the overflowed swamps.

Except for an occasional brake, the entire alluvial region north of Baton Rouge has been practically stripped of merchantable cypress. The present stand in the deep swamps consists of tupelo of all sizes

and cypress of pole size. Often the timber will run more than 15,000 feet per acre.

South of Baton Rouge the cypress swamps are much more extensive, and individual brakes cover large areas. The largest bodies of cypress in the alluvial region are found on the borders of the large shallow lakes in the lower parishes. Although cypress has been floated here, as elsewhere, the largest stands remained intact until pull boating and the more modern railroad logging with overhead skidders came into use. Logs are now brought to the mills from long distances, sometimes 80 miles or more, either by railroads or by rafts towed through the bayous by steamboats.

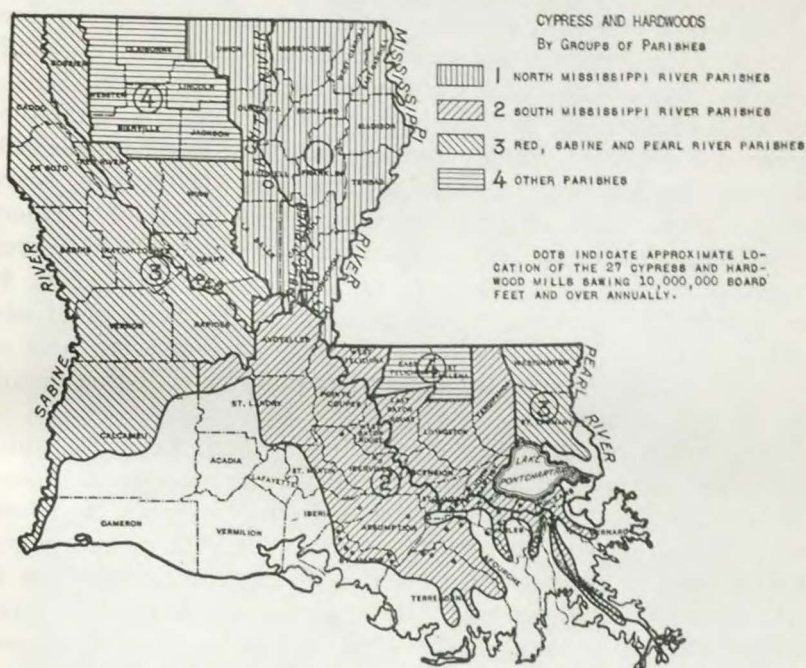


FIG. 3.—Distribution of cypress and hardwoods by groups of parishes.

In the lower Mississippi parishes cypress stumpage is worth from about \$6 to \$8 or more per thousand board feet, though it is difficult to obtain at any price. Purchasers of stumpage are usually allowed from 10 to 30 years in which to remove the timber. This is disadvantageous to the seller, since he loses the increase in value of the stumpage during the cutting period. Many lumbermen plan to hold their timber for at least 10 years before cutting it, in anticipation of higher prices when the outside supply is exhausted. Owners of cut-over land are invariably holding it in the hope that future drainage projects will make it valuable for agriculture. Meanwhile, they sell the small

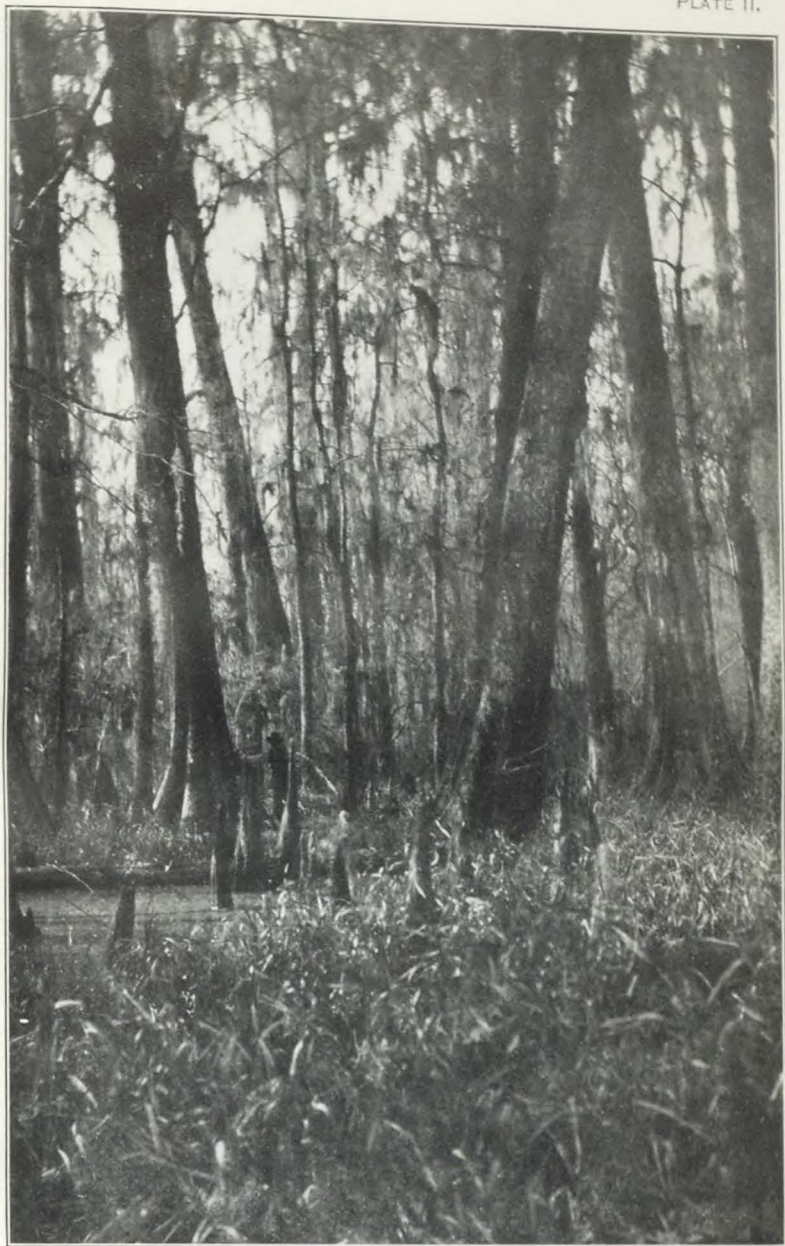
cypress to jobbers for ties and fence posts. Cut-over lands are valued at from \$2 to \$10 per acre, depending upon the distance from the bayous, amount of timber left, and feasibility of draining them.

The future value of tupelo in the cypress swamps is rarely considered. Water ash in the swamps is very inferior, and only the clearest is used in heading and oar factories. The best ash stumpage usually brings from \$4 to \$5 per thousand feet; the poorer usually is either left in the woods or used for fuel.

On the bottom type, which covers hundreds of thousands of acres, much of the best white oak has been cut by stave operators, who utilize only the select portions of the tree and leave the rest. North of the junction of the Red and Mississippi Rivers the bottom forests remain intact, except where some of the best ash and oak have been removed. The forests in this section of the alluvial region, especially in the parishes of Concordia, Catahoula, La Salle, Franklin, Tensas, and Madison, form, in fact, the largest compact bodies of hardwood timber in the United States. Average stands of merchantable oak, ash, gum, elm, hackberry, and hickory run from 5,000 to 8,000 board feet per acre. Much of this timber is in the hands of northern capitalists and is being held as speculative investment. Moreover, freight rates from this section to northern markets are about \$2 per thousand higher than on the railroads in the State of Mississippi, a fact which retards the development of lumbering west of the river. Improved river transportation, however, will soon permit the timber to be marketed.

Large bodies of timber are owned by northern furniture, automobile, and sewing-machine factories and other wood-using industries which will cut the oak, ash, and red gum to supply their own needs. The price paid for hardwood lands within the region ranged from 14 cents to \$6 or more per acre. To-day the timber alone is worth from \$25 to \$50 per acre. Red gum and tupelo together form approximately 40 per cent of the stand; red and white oak, 35 per cent; and cypress, ash, elm, hickory, hackberry, cottonwood, etc., together form the remaining 25 per cent. Oak stumpage sells for from \$5 to \$8 per thousand board feet; ash, from \$6 to \$10; red gum, from \$3 to \$5; and elm for about \$4. Cypress ties delivered at the railroads or on the levees bring about 40 cents, and oak ties about 30 cents.

On the ridge lands, the area of which is relatively small, the timber is short and often scrubby. Occasionally the ridges are wide and flat, with gum, oak, and hickory of the best quality. Often the wide ridges are in cultivation. All of the ridges are favorite feeding places for cattle and deer in winter and furnish refuge for them during periods of high water.



CYPRESS BRAKE IN THE ALLUVIAL REGION.



FIG. 1.—HARDWOOD BOTTOM IN THE ALLUVIAL REGION.

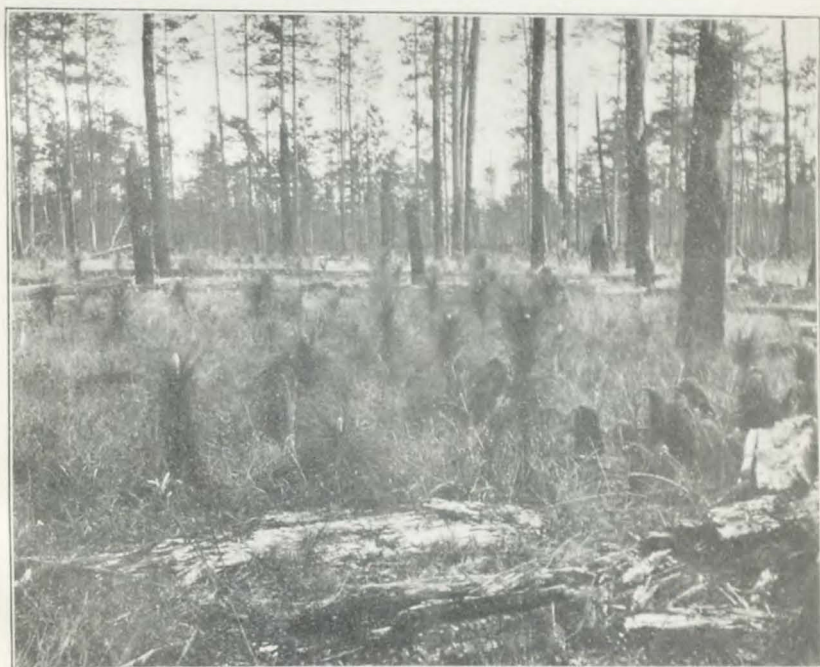


FIG. 2.—REPRODUCTION OF LONGLEAF PINE ON CUT-OVER LAND WHERE FIRES HAVE BEEN EXCLUDED FOR A FEW YEARS.

Of the remaining portions of the alluvial region the valley of the Red River is one of the most highly cultivated areas in the State. The virgin timber has almost entirely disappeared, but there are large areas of second-growth oak, gum, and cottonwood. Yellow poplar was once abundant in the well-drained coves of the slopes between the valley and the sandy pine region adjoining, where it grew to great size.

The Ouachita Valley still contains a few valuable cypress brakes. One brake in Morehouse Parish is said to average over 45,000 board feet per acre. A 150-acre tract of cypress in an adjoining parish recently sold for \$32,000. Excellent red and white oak, hickory, and red gum grow within easy hauling distance of the railroads. Valuable tie stumpage is often sold by the farmers at an average price of 6 or 8 cents a tie, which, with the waste, is equivalent to about \$1.60 per thousand feet. The value of the same timber in sawlogs would be at least \$6 per thousand feet. At distances from the railroad greater than 5 miles hardwood stumpage still has little value, and farmers girdle even the best oak and red gum in clearing the land.

Similar conditions exist in many other detached sections of the alluvial region. In the Pearl River Valley the best cypress has been removed. Along the Sabine River large amounts of cypress are still rafted to mills in Texas, though the supply will soon be exhausted. Along both rivers are unbroken forests of gum, ash, oak, hackberry, elm, and other hardwoods.

In the northern parishes about 300,000 acres, cultivated before the Civil War, are now growing up to stands of gum, ash, elm, oak, and cottonwood. Some of this second-growth timber will in a few years be more valuable than the virgin stands. The average diameter of most species is about 10 inches, but cottonwood averages 24 inches and over. The low, sandy flats of the Mississippi and other streams in the upper parishes are, in fact, especially adapted to cottonwood, which is the most salable timber, and for such purposes as headings, slack cooperage, and box boards brings from \$3.50 to \$5 per thousand feet on the stump. With the growing scarcity of cypress the value of all the other species, particularly red gum, should increase rapidly in the future.

Fires are not serious within the alluvial region. The moist soil and the dense evergreen undergrowth prevent their spread. Fires that do occur are followed by quick and abundant reproduction.

BLUFF REGION.

The bluff region is a remnant of a deposit of calcareous silt and brown loam bordering the Mississippi alluvial flood plain. On both

sides of the river, especially on the west, it has eroded down almost to the level of the surrounding country. The largest area extends from the Arkansas line to the edge of La Salle Parish. South of this small detached areas appear at intervals.

The soil is very fertile, but easily eroded. The original forests were composed chiefly of hardwoods, in which oak, hickory, beech, gum, and yellow poplar predominated, with some shortleaf pine, and a heavy undergrowth of cane, dogwood, and briers. On the bluff lands in West Carroll and Franklin Parishes were once found the best white oak and hickory in the State. The level bluff lands have been almost entirely cleared of timber and put under cultivation. The narrow strip of bluff land in the southern parishes is now almost entirely in cultivation or in pasture.

Stave and tie cutting have been carried on in the bluff-land parishes for many years, and small hardwood mills are still scattered through them. Pipe and claret staves are cut extensively in Richland and Franklin Parishes along the line of the Iron Mountain Railroad. The best white oak has been taken and much of it wasted in these operations. Pipe staves sell for from 4 to 5 cents each, and oak and ash logs for from \$10 to \$12 and more per thousand feet at the railroads. The best white-oak trees have brought a maximum of about \$2.50 to their owners. The largest tracts of hardwood land, ranging in area from 20,000 to 40,000 acres, are in the hands of northern companies. Stumpage values are somewhat higher than in the alluvial bottoms.

PRAIRIE REGION.

The prairie region occupies about one-eighth of the State. It is bounded on the north by the longleaf flats and hills, on the east by the bluff and alluvial regions, on the south by the sea marsh along the Gulf of Mexico, and on the west by the Sabine River. For the most part it is sea marsh reclaimed by the erosion of the western bluff and alluvial regions, on the south by the sea marsh along the streams, largely without trees. Toward its northern limit, however, there is an irregular hardwood growth mixed in places with pine. The greater part of the region is either in cultivation or in pasture.

SEA MARSH.

Bordering the Gulf of Mexico, from Texas to Mississippi, is a strip of sea marsh from 10 to 40 miles wide, the greater part of which is submerged by every high tide. Some of the region, however, is sufficiently elevated to make excellent grazing land. Tree growth is confined entirely to the slightly elevated portions, where

live oak grows in almost pure stands. These oak ridges were reserved more than a century ago for ship timbers, but were later restored to the public domain.

ESTIMATES OF STANDING TIMBER.

The Bureau of Corporations of the Department of Commerce and Labor has prepared a comprehensive estimate of the standing timber in the United States. In obtaining the necessary data a separate estimate was secured from every owner of timber totaling 60,000,000 board feet, or more, and other estimates were made for the aggregate of smaller holdings. The owners' estimates were checked with those of cruisers, county assessors, and others familiar with local conditions. The estimates for small tracts were also checked in every possible way. Where rectangular Government surveys had been made the holdings of each individual were plotted on sheets according to township and range to eliminate danger of duplication.¹ Since nearly all reports of standing timber were based on log scale, the estimates were increased to allow for probable overrun at the mill and offset general underestimation. For Louisiana a uniform increase of 25 per cent was made. Only timber suitable for manufacture into lumber was included in the estimates. Table 1 gives the amount of standing timber in Louisiana, as determined by the Bureau of Corporations.

TABLE 1.—*Amount of standing timber in Louisiana.*

Kind of timber.	Board feet.
Longleaf pine.....	52,500,000,000
Shortleaf and loblolly pine.....	15,200,000,000
Cypress.....	15,700,000,000
Hardwoods.....	36,400,000,000
Total.....	119,800,000,000

For the convenience of the Forest Service these estimates were arranged according to groups of parishes corresponding as far as possible with the forest regions just described.

Division of the pine areas was comparatively simple, since in Louisiana this timber is confined to three distinct groups of parishes separated by the alluvial regions of the Mississippi and Red Rivers. Table 2 shows the estimated stand of pine in accordance with this division. The parishes contained in each group are shown on the map (fig. 1).

¹ A map of west central Louisiana showing the timber holdings classified according to ownership is published in "The Report of the Commissioner of Corporations on the Lumber Industry, Part I—Standing Timber."

TABLE 2.—*Standing yellow pine in Louisiana.*

[Billions of board feet. Thus, 67.7=67,700,000,000 board feet.]

Species.	Total.	East of Mississippi River.	North of Red River.	South of Red River.
Longleaf pine.....	52.5	10.9	7.5	34.1
Shortleaf and loblolly pine.....	15.2	.6	10.1	4.5
Total yellow pine.....	67.7	11.5	17.6	38.6

More than three-fourths of the total stand of yellow pine in Louisiana is longleaf. In the group of parishes south of the Red River, including portions of Natchitoches, Rapides, and Avoyelles north of the river, longleaf forms more than half of the total stand of all species. In the group of parishes east of the Mississippi River (Florida parishes) longleaf forms almost the entire pine stand. West of Washington, St. Tammany, Tangipahoa, and Livingston Parishes the original stand was chiefly shortleaf pine, but most of the land has been cut over and is now in cultivation. There is very little pine in West Carroll, Richland, and Franklin Parishes, which are included in the group north of the Red River. What pine there is grows chiefly in Franklin Parish, and is in greater part shortleaf. Some pine is found in Acadia Parish in the middle of the prairie region. The amount of pine outside the groups shown on the map, however, is negligible. The dots on the map represent the 82 yellow pine mills each of which cuts 10,000,000 board feet or more annually. One of these mills cuts some cypress, and others may cut some hardwoods, but most of them cut pine exclusively.

Table 3 shows the estimated stand of cypress and hardwoods in Louisiana, divided chiefly with reference to the alluvial region comprising the Mississippi flood plain north and south and the minor valleys of the Red, Sabine, and Pearl Rivers. The map (fig. 2) shows the parishes included in each group.

TABLE 3.—*Standing cypress and hardwoods in Louisiana.*

[Billions of board feet. Thus, 15.7=15,700,000,000 board feet.]

Species.	Total.	North Mississippi River parishes.	South Mississippi River parishes.	Red, Sabine, and Pearl River parishes.	Other parishes.
Cypress.....	15.7	0.6	14.3	0.7	0.1
Hardwoods.....	36.4	13.8	9.5	10.9	2.2

While both cypress and hardwoods are confined chiefly to the alluvial region, cypress brakes are found also in the yellow-pine parishes, and hardwoods grow on creek bottoms almost everywhere and in mixture with pine on the uplands. The areas on the map left blank are either prairie land or sea marsh, which contain no timber of im-

portance.¹ It was not possible to establish a dividing line within the parishes for the two kinds of timber as was done with the different species of pine, but the general groups, while lacking in detail, show the relative abundance of the two kinds of timber in different parts of the State. About 97 per cent of all the cypress is in the group of South Mississippi parishes; the larger stand of hardwoods is in the North Mississippi parishes. The group of "other parishes" consists of those outside the alluvial region and contains almost no cypress and but little hardwood. The dots on the map indicate the location of the 27 cypress and hardwood mills, each of which cuts 10,000,000 board feet or more annually. Twenty-five of these mills cut cypress almost exclusively.

Each year the assessors of the different parishes submit to the State board of equalization the acreage of each class of land within the parish. On the basis of the figures for timberland submitted by the assessors for 1909, and assuming an average yield per acre, an estimate was made of the standing timber of the State for the purpose of comparison with the estimate made by the Bureau of Corporations. The result, including an increase of 25 per cent to allow for the difference between the mill cut and the log scale, gave a total stand of 97,640,000,000 board feet. This amount is about 22 per cent less than that estimated by the Bureau of Corporations, a result that might be expected on account of the probable inaccuracy of the assessors' information and the arbitrary stand per acre assumed for each class of timber.

FOREST INDUSTRIES AND ANNUAL OUTPUT.

Exceptionally complete figures showing the extent of different forest industries in Louisiana were collected in 1909 by the Bureau of the Census and the Forest Service, the usual method of securing information by correspondence being supplemented by the work of special agents for the quinquennial census of manufactures. Table 4 gives the amount and value of lumber cut in Louisiana in 1909.

TABLE 4.—*Lumber cut in Louisiana, 1909.*

Species.	Lumber cut, United States.	Lumber cut, Louisiana.	Rank.	Louisiana's proportion of total cut.	Average price, Louisiana.
	1,000 bd. ft.	1,000 bd. ft.		Per cent.	1,000 bd. ft.
Total.....	44,509,761	3,551,918	2	8.0	
Yellow pine.....	16,277,185	2,736,756	1	16.8	12.47
Cypress.....	955,635	608,854	1	63.7	20.62
Oak.....	4,414,457	74,490	15	1.7	18.63
Cottonwood.....	265,600	47,509	2	17.9	17.99
Red gum.....	706,945	34,499	6	4.9	12.91
Tupelo.....	96,676	24,703	1	25.6	12.39
Ash.....	291,209	11,200	12	3.8	21.75
Hickory.....	333,929	7,704	11	2.3	39.24
Other hardwoods (chiefly elm, sycamore, beech, and yellow poplar).....	1,773,711	6,203			

¹ Acadia Parish contains some cypress and hardwoods, but not enough to merit consideration.

Since 1905 Louisiana has been surpassed in lumber production only by the State of Washington. The output of the latter State in 1909 exceeded that of Louisiana by only 311,000,000 feet. In 1899 the leading lumber-producing States were Wisconsin, Michigan, and Minnesota. In the course of 10 years these three States have dropped to eighth, tenth, and twelfth place, respectively, while Washington, Louisiana, and Mississippi have taken the lead.

Since 1904 Louisiana has occupied first place in the yellow-pine industry. In 1899 Georgia ranked first, while Louisiana occupied seventh place. In 1909 the cut of Georgia was nearly as great as in 1899, but the cut of Louisiana was approximately three and a half times greater than 10 years before. The average annual output of yellow-pine mills in Louisiana is greater than that in any other State except Florida, the 658 active mills in Louisiana producing an average of 5,400,000 feet of lumber per year. In Virginia, on the other hand, 3,511 active mills produce less than 500,000 feet each. Louisiana has 109 and Washington 105 mills, each of which cuts over 10,000,000 board feet annually. Four mills in Louisiana each have an average of over 50,000,000 feet.

Table 5 shows the number of mills sawing yellow-pine lumber, and the output in 1909 in each of the three groups of parishes for which the estimates of standing timber were given.

TABLE 5.—Output of yellow pine in different portions of Louisiana.

Groups of parishes.	Mills.	Lumber output.
	Number.	1,000 bd. ft.
East of Mississippi River.....	119	460,236
North of Red River.....	198	950,735
South of Red River and other parishes.....	188	1,325,785
Total for State.....	505	2,736,756

The output of lumber in these different groups of parishes compared with the amount of standing merchantable timber in the same regions indicates the probable length of time which the virgin pine forests will last. Based on the output for 1909, the yellow pine of the group of parishes west of the Mississippi River and south of the Red River, for example, will be cut over in 29 years. This estimate, of course, is based only on the timber at present merchantable, and, in addition, assumes for each of the 29 years a cut equal to that of 1909. That the annual production will continue at its present figure, however, seems very doubtful, and the complete exhaustion of the virgin stands may be long deferred.

Louisiana furnishes nearly two-thirds of the country's output of cypress. The State's output of oak and gum, on the other hand, even with the vast forests of these species, forms only 1 and 2 per

cent, respectively, of the total. Arkansas, Louisiana, and Mississippi together produce more than half of the country's output of cottonwood, though the industry has steadily declined since 1899. Besides yellow pine and cypress, Louisiana also leads in the production of tupelo.

Table 6 shows the output of cypress and hardwoods for 1909 in each of the four groups of parishes for which estimates of standing cypress and hardwoods were made.

TABLE 6.—*Output of cypress and hardwoods in different portions of Louisiana.*

Groups of parishes.	Cypress.		Hardwoods.	
	Mills.	Lumber output.	Mills.	Lumber output.
	<i>Number.</i>	<i>1,000 bd. ft.</i>	<i>Number.</i>	<i>1,000 bd. ft.</i>
North Mississippi River parishes.....	31	25,565	49	62,934
South Mississippi River parishes.....	91	568,977	67	99,845
Red, Sabine, and Pearl River parishes.....	24	12,402	58	36,499
Other parishes.....	7	1,910	16	7,030
Total for State.....	153	608,854	190	206,308

On the basis of the figures given in the table and the estimates of standing timber, the supply of virgin cypress in the south Mississippi parishes, for example, should be exhausted in about 25 years. This prediction, however, is subject to the same limitations as was that for yellow pine.

The total production of laths in Louisiana in 1909 amounted to 377,708,000 from 101 mills. East of the Mississippi 8 mills cut 48,820,000 laths. North of the Red River 24 mills cut 85,025,000, and in other parishes 69 mills cut 243,863,000. Practically all of the laths were of yellow pine.

One hundred and fifteen mills produced in Louisiana, in 1909, 757,868,000 shingles, chiefly of cypress. In the north Mississippi River parishes 14 mills cut 3,625,000 shingles, and in the south Mississippi River parishes 61 mills cut 24,881,000. In the Red, Sabine, and Pearl River parishes 20 mills cut 642,408,000, and in other parishes 10 mills cut 86,954,000. As will be seen, about 85 per cent of the shingle output came from the Red, Sabine, and Pearl River parishes.

The output of slack staves in Louisiana, in 1909, was 24,300,000, of which 12,659,000 were of red gum and 7,460,000 of cottonwood. In addition, 17,228,000 oak staves were manufactured for tight cooperage. In the same year 2,162,000 slack barrel headings were produced, chiefly made up of cottonwood and tupelo, and 14,805 hoops, chiefly of pine and red gum. In addition, 864,739 sets of headings for tight barrels were manufactured. Of the 3,164,000 feet of veneer cut, more than three-fourths was cottonwood.

The naval stores industry is less important in Louisiana than in any other longleaf-pine State, except Texas. The increase in 1908 over 1907, however, was 50 per cent.

The amount of firewood used in Louisiana in 1908 is estimated at 2,524,819 cords.

FOREST PROBLEMS OF THE STATE.

GENERAL.

The yellow-pine operating companies which own extensive tracts of virgin timber are not, as a rule, adding to their holdings. They have, therefore, a fairly definite idea of the length of time their mills can run. Large bodies of timber scattered throughout the State are being purchased by capitalists, who intend to hold them until the lands owned by the large mills have been cut over. Almost invariably the holdings of the present operators are heavily bonded, in some cases for as much as \$2 on every thousand feet of lumber manufactured. In consequence, to pay the interest on these bonds, which usually runs from 6 to 8 per cent, it is necessary for the manufacturers to cut their timber regardless of the market price of lumber. Since the business depression of 1907 the net returns from the manufacture of yellow-pine lumber have been small. The necessity for paying interest on bonds, the loss of timber by hurricanes, and the heavy fixed charges of operation, coupled with low prices for lumber, have kept profits down. Small companies and individual operators, free from debt, are able to manufacture at a fair profit and can close their mills for short periods of the year, but the bonded companies must often run night and day. At present the production of yellow pine is far greater than the actual demand.

The effect of overproduction and low prices can not be anything else but bad. Because there is no profit in manufacturing low grades into lumber, many companies are compelled to leave on the ground as much as 2,000 board feet per acre in tops and logs partially affected with red heart. As a rule, only such portions of the tree as will make high-grade material are hauled to the mill. The lumbermen feel that they are in no position to take up conservative methods of logging or to make provision for a future cut of timber on the same land. It seems inevitable, therefore, that present methods of exploitation will continue as long as there is sufficient virgin timber to supply the large mills. When these have cut all of their timber and moved on, smaller sawmill companies will be established on a more permanent basis.

After lumbering, the land is usually left in a desolate condition. The industry, as a rule, does not work for permanent development of the country, nor are its earnings invested in the community. Some

companies, it is true, complete permanent improvements and leave the region in at least as prosperous a condition as they found it. They dispose of the cut-over land for agriculture at very good prices, but this results, nevertheless, in the increased settlement of the region. Much pine land is suited to agriculture, though much also is too sandy. It is not difficult, however, to separate the poorer from the fertile areas. One large lumber company, which in the course of its operation constructed a permanent railroad system, has built in the center of its lumber holdings a modern town, around which a prosperous agricultural district is planned.

Of the approximately three and a half million acres of cut-over pine land in the State, perhaps 80 per cent is well adapted to agriculture, yet much of this area will not be brought under cultivation for a great many years. Meanwhile, it remains practically unproductive, and the soil, mainly clays and sand, is badly gullied. Repeated fires prevent the young pine which has come in from getting a start, and the land produces nothing of value. Could the land be put at once to agricultural use it might be questioned whether it would be sound policy to grow young trees on areas which would produce annually a half a bale of cotton per acre. As it is, however, the land lies idle, and to grow timber on it until such time as it can be cultivated would put it to profitable use. To grow pine timber on these lands it is only necessary to keep out fire for a period of 10 years or so after lumbering.

FOREST FIRES.

In Louisiana the forest-fire problem is important chiefly in the longleaf-pine region and the shortleaf uplands, a total area of 7,500,000 acres. It is especially important, however, on the 3,500,000 acres of pine land that have been cut over. Fires are rare in the alluvial region, and those that do start in the dry bottoms are confined by numerous bayous and swamps to small areas. The bluff region is largely in cultivation.

In the longleaf pine and upland regions fires burn over the ground almost every year, consuming the fallen timber, litter, and young growth, and keeping the forests in their characteristic parklike condition. Each fire does a certain amount of damage to the mature trees and opens the way for decay. Successive fires finally weaken the trees to such an extent that they are thrown during a windstorm. Where the trees are boxed for turpentine the fire danger is, of course, greatly increased. Fires in the pine region are often set by stock owners or owe their origin to sparks from railroad locomotives. A large number also are the result of carelessness and indifference on the part of hunters and idlers in the woods, who start fires to drive

out game, or sometimes merely for the sake of seeing a conflagration. The farmers seldom set fires, except as a protective measure, when their property is in danger. On the other hand, little heed is given to fire that does not threaten buildings and fences. Many of the large holdings of nonresidents are burned over once or twice each year by owners of sheep and cattle, under the false impression that fire will improve the pasturage. This is the case in all the pine parishes, especially in Vernon and Calcasieu, where sheep grazing is most extensive.

The yellow-pine forests of the South should receive the same protection from fire as is advocated for northern coniferous forests. It would be impracticable, however, to put into effect a comprehensive scheme of fire protection until the attitude of the people in regard to forest fires has substantially changed. It must be realized that the destruction of timber, whether mature or immature, means loss not only to the individual owner but to the whole State. Large private owners could employ a sufficient protective force to insure their holdings against destruction, but the general adoption of such a plan by the State would, with the present public sentiment, fail of support.

The necessity for protecting the 3,500,000 acres of cut-over pine lands, however, is immediate. The most hazardous period in the life of a young pine stand is that between the first appearance of the young seedlings on the cut-over area and the time when the young trees attain a size that will enable them to withstand surface fires. Ordinarily, this means that cut-over areas should be given protection for from 10 to 15 years after logging.

The ideal plan on cut-over pine lands would be to conduct logging operations just previous to a heavy fall of seed and to pile and burn the slash at the time the area is logged. If slash is not properly disposed of, the first fire that burns, no matter how long delayed, will kill the young growth. If a sufficient number of seed trees are left on the logged area reproduction will take place immediately.

In some of the Northwestern States associations of timberland owners have been organized to insure the protection of their holdings from fire. The membership includes all classes of owners, from the largest corporation to the man with only 40 acres. Each member contributes to the cost of protection on a pro rata basis. The combined holdings of the members are divided into districts which are thoroughly patrolled during the danger season. Fire-fighting tools are stored at convenient points. The cost of protection to the members of the association in an average year is from 1 to 3 cents per acre. In every case these associations cooperated with the State and Federal Governments.

In 1910 a fire protective association was formed among the timberland owners of northern New Hampshire. The rate of assessment is fixed for each ensuing year by a vote of the members, the maximum being 1 cent per acre, though no member may pay less than \$25 a year. The forester for the association receives an annual salary, employs patrolmen, and, under the supervision of the board of directors, has charge of all other protective work. This consists in building telephone lines, establishing patrol routes, and preparing maps showing the topography, trails, logging roads, and other features of the country. Future work will consist in building trails and fire lines, and establishing supply stations equipped with fire-fighting tools. The association cooperates with the State of New Hampshire, and its patrolmen are appointed fire wardens.

In Louisiana similar protective measures, modified to suit conditions on the longleaf pine lands, could be made most effective. The absence of natural lookout points will, it is true, make the cost a little more than that of similar protection elsewhere, but the value of protection to large owners of timberland will fully justify the expense.

GRAZING.

In Louisiana the direct injury to the forest from stock, though it is considerable, is insignificant as compared with the indirect effects resulting from burning the woods to improve pasturage. Throughout the State cattle and hogs are at liberty to run at large in the woods. Sheep are grazed extensively, especially in certain portions of the longleaf pine region. In the swamps grazing is confined chiefly to the dry lands, although many cattle are lost in muddy sloughs. As a rule, cattle prefer cane and other green forage in the hardwood bottoms, especially in winter, when the grass in the pine woods is dead. Hogs are less fastidious, and run in the pine woods during all seasons of the year. In the bottoms they keep to the oak ridges, where acorns are abundant.

The direct damage by cattle consists in browsing the hardwood seedlings and trampling down the young growth. Most of the damage, therefore, is done in the bottoms. Hogs, on the other hand, devour the pine seed almost as soon as it falls, and during the winter tear up pine seedlings for their tender roots.

Probably more than half the fires in the pine woods are due to the practice of burning over the ground in early spring in order that the stock may obtain the new grass as soon as it appears above the ground. As a result there is a total absence of pine reproduction wherever these annual fires occur. Not only is reproduction destroyed, but the humus covering of the soil is burned, thus exposing and desiccating the sandy clay surface and causing it to become hard and impervious. The roots of the better forage grass are injured

and inferior kinds gain a foothold. Nevertheless, owners of stock continue to set fires, though by so doing they reduce the yield of forage later in the season. As long as stock is allowed to graze unrestricted in the open pine woods recurrent fires will remain a problem to be dealt with. Without adequate laws against setting fires, fencing the stock seems the only solution. While complete restriction of the right to graze stock in the open woods might be a hardship to poor farmers who depend entirely upon the pasturage to be found there, some sort of restriction is exceedingly desirable. Besides reducing the fire danger, the fencing of stock would prevent them from being killed by railroad trains and make possible better control of infectious diseases. The mere construction of a certain number of fences in the pine woods would tend, through fear of destroying them, to decrease the number of fires.

LUMBERING.

In yellow-pine logging the removal of small trees, the lumber from which is scarcely worth the cost of manufacture, is an exceedingly wasteful practice. Much young growth too small to cut is destroyed by the fall of older trees, and in few yellow-pine operations is any great care taken to preserve the young growth from damage. Waste results also from leaving sound logs in the tops of felled trees, cutting high stumps, and in the future to cut trees affected with red-heart, but which contain one or more sound logs. On account of the low price of yellow pine lumber, only the best grades can be profitably handled. Logs which could be cut into the best lumber, however, are often overlooked entirely or not cut into proper lengths.

Some yellow-pine companies, on the other hand, haul entire trees to the mill and manufacture into charcoal the tops and other portions that can not be sawed into lumber. One or two companies operate distillation plants for the manufacture of turpentine from slabs and other refuse. In other cases plants for the manufacture of paper from pine waste are being constructed.

In hardwood logging, where long hauls to the railroad are necessary, only the best material from the most valuable trees can be utilized, and the waste is correspondingly great. In the production of staves and ties there is more waste in proportion to the wood actually utilized than in any other use made of the timber. Distillation plants for the manufacture of wood alcohol and other products from beech and other species could utilize most of the material now wasted.

In the swamps there has been much waste of tupelo and other species associated with cypress. A great deal of this was unavoidable, on account of the low market value of the lumber. In future, however, tupelo, when treated with preservatives, should be marketable as poles and piles.

In turpentine operations the practice is to tap small trees, and as a result these are inevitably thrown by wind or destroyed by fire before they can be used for lumber.

Conservative methods of logging must vary with individual tracts. A fixed minimum diameter limit is not practicable in most of the yellow-pine stands. While this method is often used in regions where the forests are composed of trees of many different ages, it is unsatisfactory in the yellow-pine forests, most of which are even aged. Instead of cutting to a fixed diameter, three or four well-rooted, large-crowned seed trees should be left on each acre. These need not be trees which would cut the best lumber, and may be crooked or even affected with red-heart. If the stand consists largely of trees between 10 and 12 inches in diameter seed trees may be unnecessary. In general, where the trees in the stand are uniformly large, a second crop should be provided for by leaving scattered seed trees on the logged area, and where the stand is composed of old trees and saplings by removing only those trees which can be manufactured profitably into lumber, leaving the young ones for a later cut.

Another desirable method of logging would be to remove the timber in two cuts. The first cutting should usually include the older and larger trees, all decayed and injured trees, and some of the smaller ones from younger, even-aged groups. Perhaps 60 per cent of the stand would be removed in this cutting. There should be some care taken to provide for the even distribution of the trees left, in order to facilitate reproduction. Fifteen or 20 years later a second cutting should be made. In this, all of the stand left after the first cutting would be removed. The reproduction which would have come in in the meantime should be ample to restock the area. Fires must be guarded against, of course, if adequate reproduction is to be obtained.

Few lumbermen consider the possibility of a second crop of pine on their lands, yet by those who plan to operate their mills for from 15 to 20 years the idea should receive careful consideration. It is more than probable, in fact, that the increase in stumpage values during the period the mills are cutting present stands will more than justify the care of young growth.

In many longleaf-pine forests fully one-fourth of the area is covered by thrifty young timber under 14 inches in diameter. Much of this, as has been said, is destroyed in logging, especially where steam skidders are used. Measurements made on sixteen 40-acre plots in Tyler County, Tex., where conditions are similar to those in western Louisiana, in stands averaging 9,500 feet per acre, showed an average of from 19 to 28 per cent of the area, or about 10 acres in every 40, well stocked with young pine. While some trees below 12 and 14 inches are as old and mature as those with a diameter of

24 inches and over, the greater number are vigorous sap trees. These are developing slowly beneath the larger timber, and, if healthy and full crowned, will make rapid growth after the overtopping trees are removed.

To determine the amount of pine timber which could be reserved for a second crop without materially reducing the present cut, measurements were made on 400 acres, divided into 10-acre plots, in Tyler County, Tex. Trees intended for removal were blazed, and on certain areas where the timber was practically all mature a few wind-firm trees were reserved for seed. No attempt was made to establish a uniform diameter limit. The timber marked for removal consisted of most of that over 14 inches in diameter and those trees less than 14 inches which gave little promise of increase in growth. Under this system of cutting about 1,700 feet of timber would be left on each acre. Based on the growth during the last 20 years, and without allowance for accelerated growth after logging, the stand, including timber at present too small to be cut, would amount at the end of 20 years to 3,400 feet per acre. Lands logged in this way, if protected from fire, would readily become restocked with pine seedlings to form the basis for a third cut, if the land were not needed for agriculture.

In the longleaf-pine hills in Caldwell Parish rough counts of trees left after logging showed that over large areas an average of at least 10 trees per acre may be expected to mature during the next 20 years, under the present system of cutting. Measurements of about 200 trees in LaSalle Parish showed an accelerated growth after the mature trees had been removed of from 12 to 20 per cent a year. While the conditions described are not general over the pine regions, especially where logging operations have entirely destroyed young growth, they represent the possibility of a second cut on lands logged over in the usual manner. Under such conditions, where from 400 to 500 board feet are left after the first logging, it is not unreasonable to expect a yield at the end of 20 years of from 2,000 to 2,800 feet per acre. If care were taken during lumbering operations to reserve all vigorous trees below 12 inches in diameter, the yield in the same length of time would often be as high as 3,000 or 3,400 feet. At the probable stumpage prices 20 years from now the value of the second crop of timber would certainly justify a slight increase in the present cost of logging.

The value of reproduction on cut-over lands is difficult to determine. Land well covered with young pine, however, is certainly more valuable than the desolate cut-over areas at present so common. Except on the longleaf flats, shortleaf and loblolly pine make up the greater part of the reproduction on longleaf land. Longleaf pine produces less seed than shortleaf and loblolly, and moreover the

seeds of the latter two species, being lighter, are carried greater distances by the wind, enabling them to take possession of land formerly occupied by longleaf pine alone. The much more rapid growth of shortleaf, and especially of loblolly, and the increasing value of their woods, make it certain that second-growth pine lands well stocked with shortleaf and loblolly timber will be more valuable in future than are the best stands of longleaf to-day.

The permanent management of pine lands rests largely with lumbermen and lumber companies who own moderately small holdings free from debt. Such individuals and concerns are sufficiently identified with the region to carry on their lumber business there indefinitely. Many, in fact, are now buying at low prices pine land cut over by large companies, in order to obtain profitable returns after a period of years.

TURPENTINING.

The turpentine industry in Louisiana is comparatively new. The industry is gradually moving westward from Alabama and Mississippi into Louisiana, where at the present time it is confined largely to the longleaf flats in the Florida parishes east of the Mississippi River. In the lower parishes of the longleaf region the industry will doubtless increase rapidly within the next few years. Unfortunately it seems certain that it will be carried on more extensively on cut-over lands well stocked with young thrifty timber than elsewhere.

If not utilized soon after being tapped a considerable portion of boxed timber is damaged by fire, insects, and fungus diseases. Although loss of resin results in practically no direct injury to the trees, the butt log becomes discolored and pitchy. With the present method of chipping, practically all of the smaller trees and many of the larger ones are blown down within a few years. Only trees above 12 or 14 inches in diameter should be tapped, and then only from three to four years in advance of logging. The cup system of turpentine is not only less wasteful of turpentine but less injurious to the trees than is the present system of boxing.

For the owner of timberland proper management of turpentine operations in connection with lumbering is exceedingly important. Formerly turpentine companies owned the trees from which they obtained their product, later selling them to lumbermen. Within recent years, however, the common practice has been to purchase the turpentine privilege at a lump sum from the owner of the timber. Under both methods turpentine operations have been carried on with little regard for the value of the timber itself. It is often a temptation for a sawmill man who is in need of money to accept a cash offer made to him for the turpentine privilege. With little or no provision in the contract regulating the methods used by the turpentine

operator, pine forests have suffered lasting injury. In framing a contract for the disposal of turpentine privileges the following stipulations would prevent unnecessary injury to the timber:

(1) No boxes to be cut in the trees; (2) a cup system to be used exclusively; (3) indemnity for every tree removed during the operation or killed as a result of tapping; (4) not more than 3 cups and 3 working faces to each tree; (5) not less than 6 inches of live bark to be left between any two faces; (6) chipping not to be deeper than one-half inch; (7) faces to be worked straight up the tree; (8) all nails to be pulled out when the cups are removed; (9) timber to be worked in subdivisions and protected from fire; (10) contracts for turpentine to anticipate logging operations by not more than three or four years; (11) operations to be continued, if possible, until logging begins; (12) no trees below 12 inches in diameter breast high to be tapped for turpentine; (13) no turpentine to be done after logging.

The lumberman who carries on his own turpentine operations should be no less careful in arranging details of the work. If properly carried on, turpentine is a desirable and profitable source of revenue.

FOREST TAXATION.

In Louisiana assessed valuations of property for purposes of taxation rarely exceed 50 per cent of the actual sale value. The ratio between actual and assessed values varies with different classes of timberland. Table 7 shows the assessed and the actual value of different classes of land in Louisiana in 1909.

TABLE 7.—*Assessed and actual values of land in Louisiana in 1909.*

Classes.	Assessed value per acre.	Actual value per acre.	Per cent of assessed and actual value.	Classes.	Assessed value per acre.	Actual value per acre.	Per cent of assessed and actual value.
Pine A.....	\$18.00	\$60.00	30	Cypress C.....	\$5.00	\$40.00	12.5
Pine B.....	12.00	32.00	37.5	Denuded cypress...	1.80	5.00	12.5
Pine C.....	5.00	20.00	25	Hardwoods.....	3.50	25.00	14
Denuded pine.....	1.00	2.00	50	Sugar lands.....	18.00	100.00	18
Cypress A.....	20.00	120.00	16.6	Rice lands.....	5.00	10.00	50
Cypress B.....	12.00	64.00	18.7	Cotton lands.....	10.00	30.00	53.3

In 1909, for assessment purposes, pine, cypress, and hardwood lands were each separated into three classes of timberland and one class of denuded land, according to the stand of timber per acre. In 1910 four classes were established for pine, and recommendation was made by the State board of equalization that the same number of classes be established in future for cypress. Each owner is required to return a tax list showing the acreage of each class of land

included in his holdings. As a rule, this has been done accurately, except in the case of hardwoods, which are very hard to classify. A few parishes have employed estimators to classify their timberlands.

The tax rate depends chiefly upon whether the property is located within the levee districts. Outside the districts, the rate consists of a State tax of 5 mills, a parish tax of 8 mills, and a school tax of about 5 mills. In general, the upland tax rate rarely exceeds 2 per cent, or 20 mills on a dollar. Within the levee districts the different parishes have, in addition to the taxes mentioned, a so-called acreage, a district levee, and a produce tax, assessed by the levee boards for the completion and maintenance of levees. The State board of equalization is charged with the final adjustment of taxes among the different parishes.

There is comparatively little complaint of excessive taxation, except from some owners of pine land, who, because of the low price of lumber and the loss from storms, claim that the rapid increase in the assessed valuation of their holdings deprives them of legitimate profits, and causes them to cut their timber faster than they otherwise would. A few companies have erected additional mills to complete their cuttings sooner. As a matter of fact, increases in assessment of value of pine, cypress, and hardwood holdings have done little more than keep pace with the value of stumpage.

Cypress timberland is taxed less in proportion to its actual value than is pine land. Cypress stumpage, though twice as valuable, is assessed at about the same figure as pine. The inequality is offset to some extent by the addition to the cypress assessment of a levee tax which the pine lands do not have to bear, and by the higher cost of logging cypress timber.

Tax sales are infrequent everywhere in the State. Lands forfeited for the nonpayment of taxes are usually redeemed by the owners before the period of redemption has passed. Failure to pay taxes is usually due to negligence or to temporary lack of funds, rather than to an intention to abandon the land. One cypress company, however, abandons its cut-over lands each year.

Taxes on timberland in Louisiana are not a heavy burden upon the owners, although they are higher than in some of the other Southern States. That timberlands are not assessed at their full value, however, is due to the officials. With the tendency to increase the valuation from year to year, the rate of taxation may become so high that owners of timber will be compelled to cut over their holdings as quickly as possible.

It is generally held by students of the subject that correct principles require the taxation of forests according to their yield, rather than on the basis of property value. Reasonably fair results would

be obtained by separating the timber from the land for purposes of taxation, and taxing the land annually for its value without the timber, and levying an additional tax of from 10 to 15 per cent upon the timber when it is cut. Unfortunately, such a system would be unconstitutional in Louisiana, and the owner of timberland must, for some years at least, formulate his plans to accord with the present method.

DEVELOPMENT AND MAINTENANCE OF FARM WOODLOTS.

The need for a permanent local supply of timber for farm use arises wherever the forest is giving way to agricultural development. In Louisiana this is the case in the uplands and bluff regions east of the Mississippi River, in the prairies, and in the northern part of the State west of the Mississippi. Along the creeks in the uplands mixed stands of hardwoods and pine ought to furnish a supply of timber indefinitely.

Even in the most fertile localities not all of the land can usually be cultivated, and every farmer might well reserve a portion of his farm as a woodlot. Fires should be kept out, and the woodlot should not be used as a pasture. The most valuable species in the woodlot should not be cut below a diameter limit of from 15 to 18 inches, though less valuable ones could be cut to a lower size. Dead and down trees should be worked up for fuel. In cutting live timber the old, mature trees should be removed first, care being taken not to injure thrifty young trees, the rate of growth of which increases rapidly after they have been given room to develop. Where young trees are so close together that their growth is retarded, a general thinning of the woodlot should be made.

Trees that are affected with decay should be cut out and the brush burned in order to prevent the spread of the injury. All pine in Louisiana is subject to attack by the Southern pine beetle, an insect which under favorable conditions is capable of killing an enormous amount of pine timber in a short time. The identification of the work of this insect and the methods necessary for its control are outlined in Farmers' Bulletin 476 of this department.

The woodlot should furnish posts and poles, railroad ties, firewood for the home and neighboring towns, and a supply of timber for building and repairs.

The woodlot should never be culled of its best timber. In selling timber from the woodlot it is generally best to draw up a contract specifying what trees shall be cut, the price to be paid and the manner of making payments, what scale, if any, shall be used and who shall do the scaling, and what precautions are to be taken to prevent the spread of fire and of injury to young growth. Long-time con-

tracts which allow the purchaser 10, 20, and 25 years in which to remove the timber are almost invariably disadvantageous to the owner. The prospective value of a well-managed woodlot in Louisiana is considerable. The trees grow rapidly, particularly on abandoned fields, where loblolly and shortleaf pine will often average 15,000 feet per acre in 30 years. Telephone poles may be grown in 25 years and saw timber in from 40 to 50 years. Oak, ash, gum, and pine are usually the best species for the woodlot.

PLANTING.

Where fire is kept out abundant reproduction will usually come in on cut-over pine land without the aid of planting. In some cases, however, large areas have been completely stripped of timber, leaving no trees to furnish seed. Similar conditions may occur where turpentine operations have destroyed all seed trees left after logging.

On badly eroded land, such as that in portions of the bluff region and the uplands of the State, planting would be of great benefit. Large areas between the Mississippi River and its levees should be planted to cottonwood and willow, in order to protect the levees from erosion during high water. This work might well be undertaken by the State. In the prairies and in other parts of the State where good fence-post material is not plentiful, black locust could be grown with profit to supply this demand. Experiments with catalpa for railroad ties and fence posts being carried on in the alluvial region promise to meet with success, even on land with little value for other purposes. Some attention has recently been given in Louisiana to the planting of eucalyptus. While these trees have an exceedingly rapid growth and the wood of some species is very valuable they are not frost hardy. As yet eucalypts have been grown commercially only in southern California, but they have been planted for ornament in southern Texas, Arizona, and Florida, where the temperature rarely falls below 22° above zero. In Louisiana the planting range for eucalyptus is probably confined to a narrow strip along the Mississippi below New Orleans. It is possible, however, that the hardier species could be grown in other places along the Gulf of Mexico.

MANAGEMENT OF STATE LANDS.

Had the millions of acres of alluvial land, once the property of the State, been classified, and the portions chiefly valuable for timber reserved, Louisiana would now be in possession of the finest bodies of hardwood timber in the country. These lands were sold, often for a few cents an acre, and the only benefit received by the State has been the annual tax paid by the owners. The wisest policy in

handling the remaining lands owned by the State would seem to be to place them under perpetual State management, leasing the agricultural rights and selling the timber at current market prices as it matures. Moreover, it might be possible for the State to purchase denuded lands at a price not to exceed \$2 per acre, place them also under management, and protect them from fire. If private owners are able to hold their cut-over lands for future returns, as some are already doing, it would seem that the State, which is perpetual and not subject to taxation, could afford to do so. Such tax lands as are chiefly valuable for the growing of timber might also be reserved by the State as part of its forest system. The remaining school sections could be reserved and maintained under the same plan, the income being used as now for the benefit of the schools.

In 1905 Wisconsin set aside all the State lands bearing timber, a total area of more than 250,000 acres. Additional land has been purchased and the area of State forests now amounts to 385,000 acres. The forest land about Itasca Lake, at the headwaters of the Mississippi River, has been reserved by the State of Minnesota. Michigan has over 230,000 acres in State forests. As early as 1897 the Pennsylvania Legislature authorized the creation of State forest reserves through the purchase of land at tax sales. Two years later the State was authorized to purchase timber lands at a maximum price of \$5 per acre. At the present time Pennsylvania has more than 920,000 acres in reserve. New York State, starting with a nucleus of 300,000 acres of State land, has by purchase and gift increased the State forest reserves to 1,640,000 acres. Other States which have inaugurated the policy of establishing forest reserves are Maryland, Connecticut, New Hampshire, Vermont, New Jersey, and Massachusetts.

SUMMARY.

Protection of cut-over lands from fire is the most important forest problem in Louisiana. Though the greater part of the State lands is well adapted to agriculture, it will be many years before the area is put to cultivation. In the meantime, the growth of pine should be encouraged on the otherwise unproductive land. Brush disposal after logging and the restriction of grazing would greatly lessen the fire danger.

Owners of timberland should endeavor to prevent, as far as practicable, all forms of waste in logging, such as injury to young growth, the use of valuable timber where inferior stuff will answer the purpose, the leaving of sound logs in the woods, and the cutting of high stumps. The future value of the young trees in the forest will justify those owners who plan to continue their operations for a period of years to protect them during the first logging, in anticipa-

tion of a second crop. Small trees left after logging should not be boxed for turpentine. Turpentineing should, in fact, be carried on ahead of logging operations, and under the cup system.

Forest taxation, while not at present a serious problem in Louisiana, is unjust to owners of young timber, the value of which is merely prospective.

Farm woodlots should be established and maintained in agricultural sections to furnish fuel, fence posts, poles, and the lumber needed for repairs. Where a supply of fence posts and other similar timber is not available, catalpa and other fast-growing trees might be planted with profit. Cottonwood and willow planted outside the levees would help to protect them from erosion during high water.

There is an excellent opportunity for the State to place under management the forest lands still in its possession, those received as gifts, and those reverting for nonpayment of taxes.

PROGRESS OF FORESTRY IN LOUISIANA.

Since 1855 Louisiana has from time to time made provision for the proper protection and use of timber, without attempting, however, to coordinate the various enactments. This has resulted in much fragmentary and unrelated legislation. The first effort toward the adoption of a comprehensive forest policy was made in 1904, when an act was passed providing for the establishment of a department of forestry and a fire-warden system, and fixing penalties for the willful, careless, or malicious setting of forest fires. The attorney general ruled, however, that the act carried with it no appropriation other than that for the office of commissioner of forestry and that for clerical work and printing, and under these circumstances the organization of the commission was thought to be inexpedient. In 1908 the legislature provided for a temporary commission of natural resources to consist of seven members, which was to report to the legislature in 1910 upon the condition of the forests and other natural resources in the State, with recommendations for their preservation. At the same session a chair of forestry was established at the Louisiana State University. The latter act carried with it no appropriation, and the chair has not been filled.

In 1910, as the result of the report by the commission of natural resources, three important laws were enacted. The first of these creates a permanent conservation commission of 8 members, 3 of whom are *ex officio*—the superintendent of experiment stations, the State forester, and the chief engineer of the State board of engineers. Five other members are appointed by the governor. The duty of the commission is to report on forest conditions in the State, the drainage and reclamation of swamp lands, the prevention of waste in the extraction of oil, gas, and other minerals, and all other matters

relating to the conservation of the State's natural resources. It has supervision of the department of forestry and of other departments dealing with the natural resources of the State, and reports biennially to the general assembly. The act carries with it an appropriation of \$1,800 a year.

The second act creates a conservation fund to be used partly for fire protection and to be derived from an annual revenue tax upon all persons and companies removing timber and minerals from the land. It also prescribes the methods by which those subject to the tax shall make reports on their business. Tax on lumbering is based on the gross annual cut, at the following rates:

One cent per thousand feet log scale on pine cut for sawlogs and square timber.

Three-fourths of a cent per thousand feet on hardwood timber cut for sawlogs.

One cent per hundred on stave bolts.

Three-tenths of a cent each on telephone and telegraph poles.

One cent each on piles.

One-fourth of a cent per year for each cup or box on turpentine operations.

While this act became effective November, 1910, the operation of the license tax has been delayed pending litigation brought by certain lumber interests.

The third act in 1910 strengthens the law of 1904, which established the department of forestry, to consist of the register of the State land office as ex officio State forester and one deputy State forester educated in silviculture, and commissioned by the governor on the recommendation of the conservation commission, which has general supervision of all matters pertaining to forestry. The State forester, however, has direct control and is required to prevent and extinguish forest fires and to carry on educational work in the interest of forest preservation.

He is also authorized to cooperate with timber owners in making plans for forest protection and management, to examine the State timberlands and to recommend whether they shall be held as State reserves, and to protect and manage all lands so reserved. Further, he is to make a study of forest conditions and resources throughout the State, to conduct experiments in tree planting, and in the effect of grazing and turpentine upon the forest. As ex officio State forester he receives a salary of \$500 from the general fund.

The deputy State forester is the chief assistant in carrying out the State's forest policy. The act carries an appropriation of \$2,400 for his salary and expenses, payable out of the conservation fund. No deputy forester has been appointed, however, because there is now no money available.

While the law makes no specific provision for a system of forest-fire protection, the State forester is required to prevent and control forest fires, and he may employ fire wardens and patrolmen if they are needed. Money for the payment of this force will be supplied by the conservation fund when it is available.

Penalties are provided for setting fires. Railroad companies are required to keep their rights of way cleared of combustible material during the danger season; that is, between November 15 and April 15. In seasons of drought they must see that their section crews prevent or promptly extinguish all fires which originate on the rights of way, and train crews must report promptly all fires. There are adequate penalties for the violation of these provisions. No part of the forest law affects the right of action for damages. Individuals or corporations are liable for all fire damage, including injury to young growth, and the cost of fighting fires may be assessed as part of the penalty for willful, negligent, or malicious setting of fires.

The conservation commission is authorized to purchase lands for forest purposes at not more than \$1 per acre. The money for this purchase is furnished by any surplus that exists in the conservation fund. The lands are bought in the name of the State and placed under management as forest reserves. Moreover, the governor is authorized to accept gifts of land, but the total area of State forest within any parish shall not exceed 10 per cent of the parish.

Besides those provisions which established the State forest organization and State reserves, there are a number of miscellaneous provisions covered by the act. For example, consent is given to the United States to acquire land up to 100,000 acres within the State for the establishment of a National Forest.

Electric or power companies can not attach wires or appliances to street trees.

Boards of education are directed to provide for general courses of instruction in forestry and for the celebration of Arbor Day.

In order to encourage forestry, it is provided that land which is worth not more than \$5 per acre may be assessed at \$1 for a number of years if it is planted to trees and protected. The payment of the tax which accrues through this lower assessment is deferred until the end of the definite period during which the lower assessment is in force.